Instrumented Suit Hard Upper Torso (HUT) for Ergonomic Assessment

Completed Technology Project (2012 - 2012)

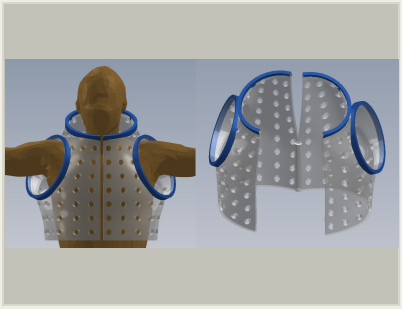
Project Introduction

It is well known that the EVA suit (EMU) has the potential to cause crew injury and decreased performance. Engineering data on the suit interaction of the human within the suit are currently difficult to obtain, but are sorely needed to enable designers to make the necessary changes to current designs and optimize future designs. Quantifiable physical performance and human-suit interaction data are essential to understand/overcome the current limitations of the suit. A transparent hard upper torso (HUT) was built to be instrument-friendly, allowing ergonomists and designers to shed new insight into what is happening inside the HUT with quantifiable and relevant data.

Crewmembers undergo strenuous suited training for EVA missions. Frequent exposure to such activities can eventually lead to Cumulative Trauma Disorders/Injuries and reduced performance (results which are already well documented for the EVA suit). Engineering data such as dynamic fit, mobility and human-suit contact measurements within the suit are currently difficult to obtain, but is sorely needed to enable designers to make the necessary changes to current designs and optimize future designs. Physical performance and human-suit interaction data are thus essential to shed new insight into what is happening inside the HUT. Relevant and currently hard to obtain human interaction data inside the suit should enable NASA to build a 21st century suit. A transparent EVA-type suit HUT with adjustable components was designed and manufactured. The transparent HUT can be attached to an adjustable-height stand, or worn directly on the body with a restraining harness to keep the transparent HUT's relative position the same as an actual HUT when worn. The transparent HUT was designed to weigh a mere fraction of the actual HUT and therefore facilitate functional testing. A brief pilot study showed that the HUT did indeed fit the subject similarly to an actual EMU HUT, with restrictive internal volume and mobility, and that it greatly improved the ability to gather internal volumetric and interference data and allowed visual/video inspection of internal interfaces.

Anticipated Benefits

Prototypes and mockups of this nature cost a small fraction of more developed prototypes. Allowing engineers and designers the ability to prototype concepts and verify design requirements early on in the design phase, will greatly improve final outcomes, schedule, and development costs. As is often seen in production industries, a missed flaw in a product becomes exponentially more expensive to fix as the design and manufacturing process advances.



Project Image Instrumented Suit Hard Upper Torso (HUT) for Ergonomic Assessment

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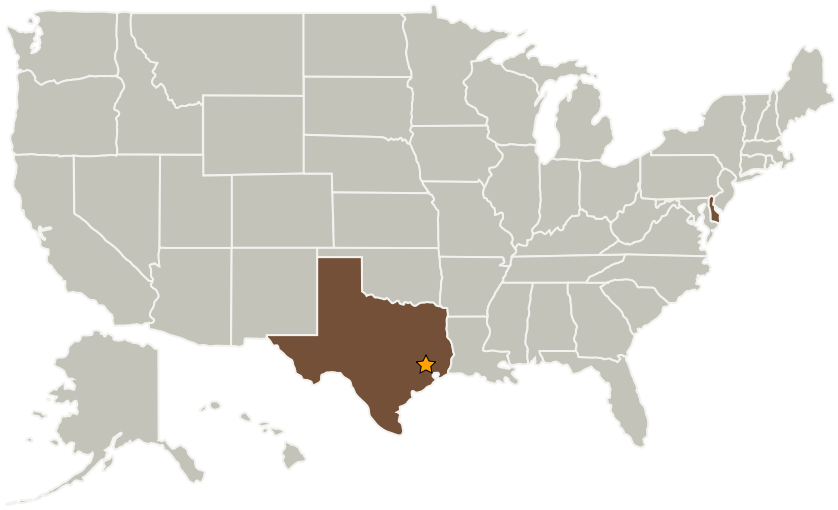
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Lockheed Martin Space Systems(LMSS)	Supporting Organization	Industry	Sunnyvale, California

Primary U.S. Work Locations	
Delaware	Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Sudhakar L Rajulu

Principal Investigator:

Sudhakar L Rajulu

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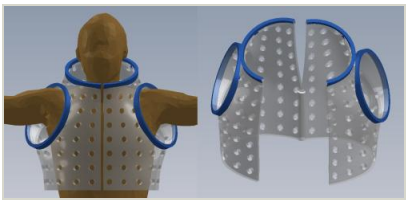
Images



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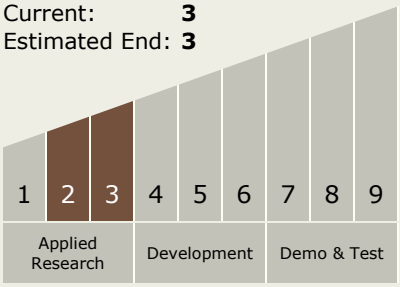
Project Image Instrumented Suit Hard Upper Torso (HUT) for Ergonomic Assessment
(https://techport.nasa.gov/image/2273)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.2 Prevention and Countermeasures